REMARKS

Claims 1-22 are now pending in the application.

As will be described in further detail below, Applicants' assert that a switched reluctance machine with a segmented stator is novel. More particularly, Applicants' also assert that an electric power steering system with the switched reluctance machine with the segmented stator is also novel. Applicants have filed numerous U.S. and foreign patents that relate generally to switched reluctance motors with segmented stators and to various applications of switched reluctance motors with segmented stators. Applicants are citing prior art identified in these U.S. and foreign applications in an effort to provide a full disclosure of potentially relevant prior art.

The Examiner is respectfully requested to reconsider and withdraw the rejection(s) in view of the amendments and remarks contained herein.

REJECTION UNDER 35 U.S.C. § 103

Applicants traverse the rejection of Claims 1, 9 and 16 under 35 U.S.C. § 103(a) as being unpatentable over Kilman et al. (U.S. Pat. No. 4,896,089) in view of Admitted Prior Art and further in view of Nishiyama et al. (U.S. Pat. No. 6,049,153).

Regarding Claims 1, 9 and 16, none of the references does not show, teach or suggest an electric power steering system including a stator with a plurality of circumferentially-segmented stator segment assemblies. None of the references show, teach or suggest a switched reluctance electric machine wherein the rotor tends to rotate relative to the stator to maximize the inductance of an energized winding, which is a characteristic of switched reluctance motors.

Kilman et al. shows an electric power steering system including a switched reluctance machine with a non-segmented stator core. There is no teaching or suggestion in Kilman et al. for segmenting the stator of the switched reluctance machine.

Nishiyama et al. teaches a segmented stator but does not disclose a switched reluctance electric machine or an electric power steering system.

In making the combination, the Examiner asserts that the combination would be "obvious since [segmenting the stator] is extremely common in the motor art". Office Action p. 4.

The facts in this case are contrary to the Examiner's assertion that it would be obvious to combine the references. Despite the existence of the two separate teachings for over 50 years (as described below), no one has made the combination. If the combination is obvious, then why has it not been done? Maybe it has been done, but since such would have been obvious, it would be no patentable invention

For over 160 years, machine designers have employed a non-segmented stator in switched reluctance machines. One of the earliest recorded switched reluctance motors was built by Davidson in Scotland in 1838. "Switched Reluctance Motors and their Control", T. J. E. Miller (Magna Physics Publishing 1993), p. 5 (attached hereto).

Non-segmented stators in switched reluctance machines continued to be used for over 50 years <u>after</u> the use of segmented stators in other types of electric machines. Sheldon (U.S. Patent No. 2,688,103, which was issued in 1952) teaches a segmented stator for an electric machine to improve the efficiency of the electric

machine (Col. 1, lines 17-24), but does not disclose the use of the segmented stator in a switched reluctance machine.

Neither the Examiner nor Applicants are able to identify any examples of switched reluctance machines with a segmented stator. This may be due to one of the key advantages of switched reluctance motors ~ simple construction. In the Introduction of "Switched Reluctance Motors and their Control", Miller states:

> The geometry [of the switched reluctance motor] is beguilingly simple, and everything about the motor and its control seems at first sight to be a gift to the production engineer. Yet the attainment of good designs and satisfactory performance is practically impossible by traditional design methods.

See Introduction attached hereto. Segmenting the stator clearly increases the complexity of the design, which is counter to one of the primary reasons for using switched reluctance machines in the first place.

Based on the foregoing, it is clear that the conventional wisdom is to use non-segmented stators when designing switched reluctance machines. Proceeding against the conventional wisdom is evidence of nonobviousness. Arkie Lures Inc. v. Gene Larew Tackle, Inc., 43 USPQ2d 1294, 1297 (Fed.Cir. 1997); In re Hedges, 783 F.2d 1038, 1041, 228 USPQ 685, 687 (Fed. Cir. 1986). Here, Applicants have made the construction of the electric power steering system with a switched reluctance motor more complex by segmenting the stator. The geometry is no longer "beguilingly simple".

While improved slot fill is achieved by segmenting the stator, the primary motivation for segmenting the stator was to improve manufacturing tolerances and the electrical characteristics of the switched reluctance machine. The unconventional

approach allowed Applicants to overcome the "practically impossible" task of obtaining satisfactory performance while being cost competitive in the marketplace. There is no teaching or suggestion in any of the references that segmenting the stator would improve the electrical characteristics of the stator and provide more robust sensorless rotor position sensing.

Switched reluctance machines selectively energize one set of phase windings to produce output torque. A controller connected to the switched reluctance machine requires a rotor position signal to energize of the phase windings at the correct time. The rotor position signal can be generated using a rotor position transducer or using a sensorless approach. Because the cost of rotor position transducers generally places switched reluctance machines at a competitive disadvantage with respect to other types of machines, commercial applications have attempted to use the sensorless approach.

Segmenting the stator in a switched reluctance machine provides results that are unique to switched reluctance machines. Namely, segmenting the stator allows the windings to be positioned far more accurately, which improves the resistance and inductance characteristics of the stator teeth. As a result, sensorless operation can be employed more effectively, which lowers the cost of the switched reluctance machine. The improved manufacturing tolerances allow less costly drive circuits and/or more accurate control of the switched reluctance machine.

For the foregoing reasons, Applicants respectfully assert that claims 1, 9 and 16 are allowable. The remaining claims are either directly or indirectly dependent upon claims 1, 9 and 16 and are allowable for the reasons set forth above.

CONCLUSION

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1211.

Respectfully submitted,

Dated: September 18, 2002

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ATTACHMENT FOR SPECIFICATION AMENDMENTS

The following is a marked up version of each replacement paragraph and/or section of the specification in which underlines indicates insertions and brackets indicate deletions.

[0005] The design and operation of switched reluctance electric motors is known in the art and is discussed in Stephenson and Blake, "The Characteristics, Design and Applications of Switched Reluctance Motors and Drives", presented at the PCIM '93 Conference and Exhibition at Nuremberg, Germany, June 21-24, 1993[, which is hereby incorporated by reference].